

**BACKGROUND SAMPLING ANALYSIS FOR
ELECTRIC ARC FURNACE BAGHOUSE
HAZARDOUS WASTE MANAGEMENT UNIT**

Prepared for:
**AMERICAN STEEL FOUNDRIES
ALLIANCE, OHIO**

Prepared by:
**RMT, INC.
SCHAUMBURG, ILLINOIS**

NOVEMBER, 1993

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Section 1
BACKGROUND

Soil samples were collected and analyzed to determine background concentrations for barium, cadmium, chromium and lead. Six samples were collected off-site and six samples were collected on-site. See Figure 1. The sampling locations were approved by the Ohio EPA as per the revised Closure Plan for Electric Arc Furnace Baghouse Hazardous Waste Management Unit, May 1993, RMT, Inc. In accordance with the closure plan, the Upper Confidence Limit (UCL) for each constituent of concern will be calculated as the mean of the background population plus two times the standard deviation. The UCL will be used as the point of comparison for soil samples collected in the closure area. In the case of lead, the Ohio EPA will not allow the calculated UCL to be higher than 150 mg/kg.

To determine if the background population effectively reflects a normal distribution, probability plots and statistical tests will be completed on the sample population. For this analysis the Kolmogorov-Smirnov test using Lilliefors Critical Values¹ was used to determine the adequacy of the normal assumption. Where non-normality was indicated, a log-normal transformation was made and tested as well.

In addition, the two sample Kolmogorov-Smirnov test was applied to assess whether the off-site and on-site sample distribution are the same.

Finally, the appropriate UCL determinations were made and tabulated. Recommendations are made for the appropriate UCL for each of the constituents.

¹1967 Lilliefors, Huber W. "On the Kolmogorov-Smirnov Test for Normality with Mean and Variance Unknown", J. Amer. Stat. Assoc., June 1967, pp. 399 - 402.

Section 2
Discussion

The following table lists the analytical results for barium, cadmium, chromium and lead for the off-site and on-site soil samples. Copies of the analytical reports are in Appendix A. Samples numbered 006 and 007 are laboratory duplicates; hence, for the statistical analysis we have used the average of these two reported values resulting in six off-site and six on-site background measurements.

DATA USED FOR SETTING UCL FOR BACKGROUND CONCENTRATIONS						
Sample	Loc. #	Description	Analyte Concentration, mg/kg			
			Barium	Cadmium	Chromium	Lead
001	1	off-site	9.3	0.5 ¹	69.9	25.3
002	2	off-site	85.5	0.5 ¹	2330.0	25.7
003	3	off-site	212.0	0.5 ¹	87.6	25.9
004	4	off-site	92.8	0.5 ¹	260.0	36.3
005	5	off-site	0.5 ¹	0.5 ¹	1.0 ²	5.0 ³
006	6	off-site	119.0	0.5 ¹	69.3	63.6
007 ⁴	6	off-site	118.0	0.5 ¹	97.0	241.0
008	7	on-site	148.0	0.5 ¹	12.7	148.0
003	8	on-site	103.0	0.5 ¹	16.7	16.8
0010	9	on-site	296.0	0.5 ¹	19.5	498.0
0011	10	on-site	61.1	0.5 ¹	15.1	12.0
0012	11	on-site	64.6	0.5 ¹	13.9	43.6
0013	12	on-site	205.0	0.5 ¹	21.5	165.0

¹ DL = 1.0 mg/kg, used DL/2 in statistical analysis
² DL = 2.0 mg/kg, used DL/2 in statistical analysis
³ DL = 10.0 mg/kg, used DL/2 in statistical analysis
⁴ Samples 006 and 007 are lab duplicates; used average in statistical analysis

All reported values for cadmium were below the method detection limit. Therefore, we recommend that the UCL for cadmium be set by estimated the standard deviation as $[(DL/2)^2 + 3]^{1/4}$, the theoretical standard deviation of a rectangular distribution. Hence, for cadmium, the proposed UCL is:

$$\begin{aligned} UCL_{Cd} &= \text{mean} + 2 * [(DL/2)^2 + 3]^{1/4} \\ &= 0.288 + 0.25 = 0.608 \end{aligned}$$

For sample 005, barium, chromium and lead values were below the method detection limit. For these analyses, on-half the method detection limit was used as the reported value.

Normal and log-normal Probability plots were prepared for the off-site and on-site analysis as shown in Figures 2a, 2b and 2c. In general, it appears that the log-normal probability plots fit the data better than the normal distribution. Figure 3 shows just the selected probability plots.

To test the lack of fit, Kolmogorov-Smirnov statistics and the Lilliefors critical value were calculated for normal and log-normal distributions and are summarized as follows:

KOLMOGOROV-SMIRNOV STATISTICS N=6						
Assumed Distribution						
NORMAL				LOG-NORMAL		
Constituent	K-S Statistic	Sig.Level	Lilliefors Critical Value N=6 d=.05	K-S Statistic	Sig.Level	Lilliefors Critical Value N=6 d=.05
Barium, off-site	0.1732	0.9937	0.319	0.3367*	0.5045	0.319
Barium, on-site	0.1823	0.9985	0.319	0.1822	0.6552	0.319

KOLMOGOROV-SMIRNOV STATISTICS N=6 (Continued)						
Assumed Distribution						
Constituent	NORMAL			LOG-NORMAL		
	K-S Statistic	Sig.Level	Lilliefors Critical Value N=6 d=.05	K-S Statistic	Sig.Level	Lilliefors Critical Value N=6 d=.05
Chromium, off-site	0.4250*	0.2286	0.319	0.3078	0.6206	0.319
Chromium, on-site	0.1677	0.9959	0.319	0.1477	0.9994	0.319
Lead, off-site	0.3985*	0.2964	0.319	0.2983	0.6596	0.319
Lead, on-site	0.3436*	0.4782	0.319	0.2820	0.7265	0.319

* values of K-S statistic which are greater than the Lilliefors critical value indicating poor fit to the assumed distribution.

Based on these statistics, no transformation is required for barium. For chromium and lead, the log-normal transformation should be used to normalize the data.

As a further test, the Kolmogorov-Smirnov Two-Sample test was applied to determine whether the off-site and on-site results could have arisen from the same distribution. The results of this test were:

Kolmogorov-Smirnov Two Sample Test
Off-site vs. On-site

	<u>K-S Statistic</u>	<u>Sig. Level</u>
Barium	0.333	0.8928
Chromium	0.833	0.0310*
Lead	0.667	0.1389

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This analysis indicates that the off-site and on-site chromium distributions are not the same. This more than likely is a result of the single large value for sample #002. We recommend that based on the analysis of the means and standard deviations of the two distributions that they be pooled. Appendix B contains the statistical worksheets.

Based on the above analysis, the following table summarizes the UCL's for the various constituents:

UPPER CONTROL LIMITS				
Constituent	Est. Mean	Est. Standard Deviation	UCL mg/kg	Comments
Barium	116.4	84.7	286	based on pooled, normal distribution
Chromium	1.563*	0.779*	1321	based on pooled log-normal distribution
Cadmium	0.5	0.144	0.608	based on uniform distribution
Lead	1.725*	0.5204*	582 150 ¹	based on pooled log-normal distr. ¹ based on Ohio EPA rules

* Log 10 of mean and/or standard deviation

FIGURES

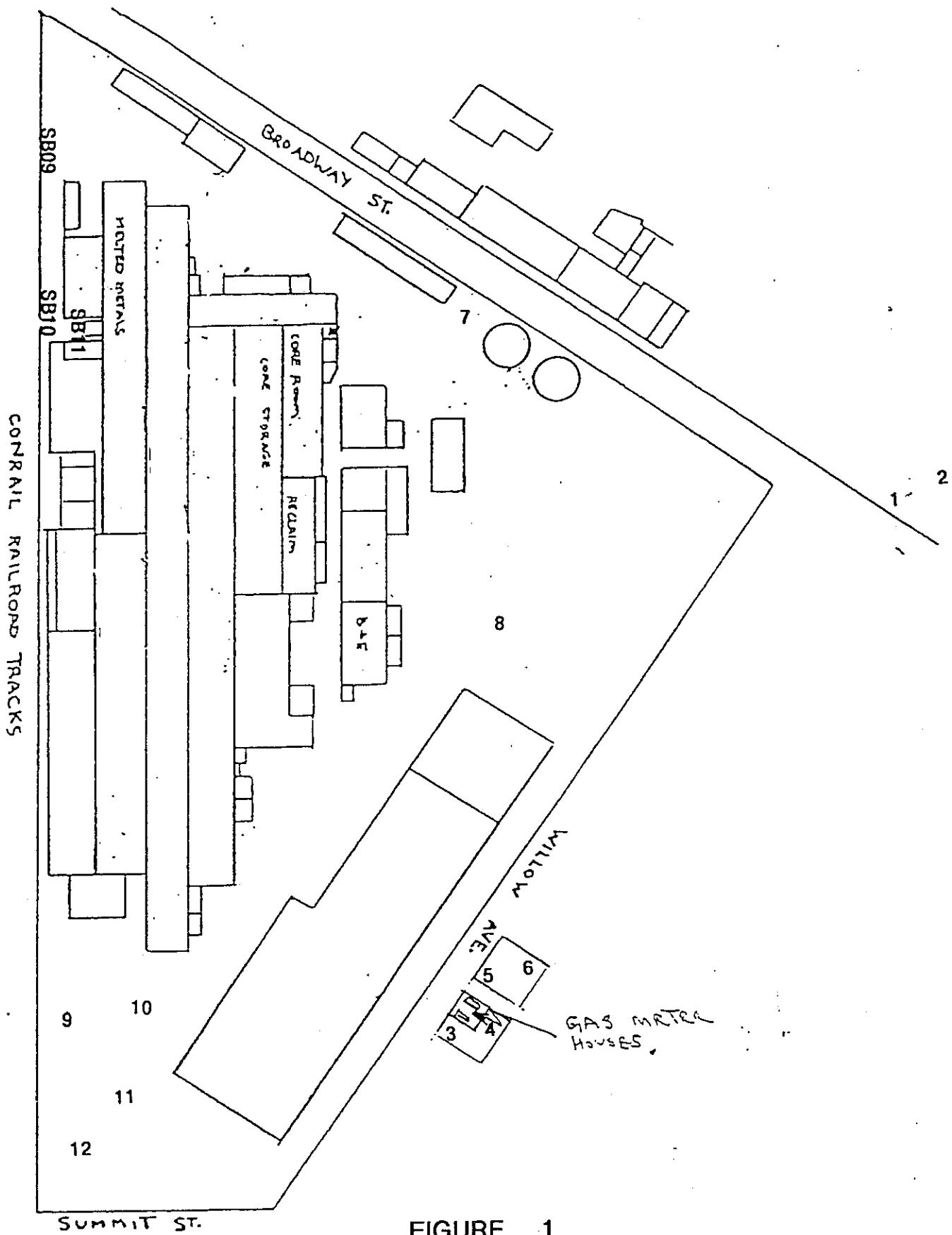


FIGURE 1

12 BACKGROUND SOILS SAMPLING LOCATIONS

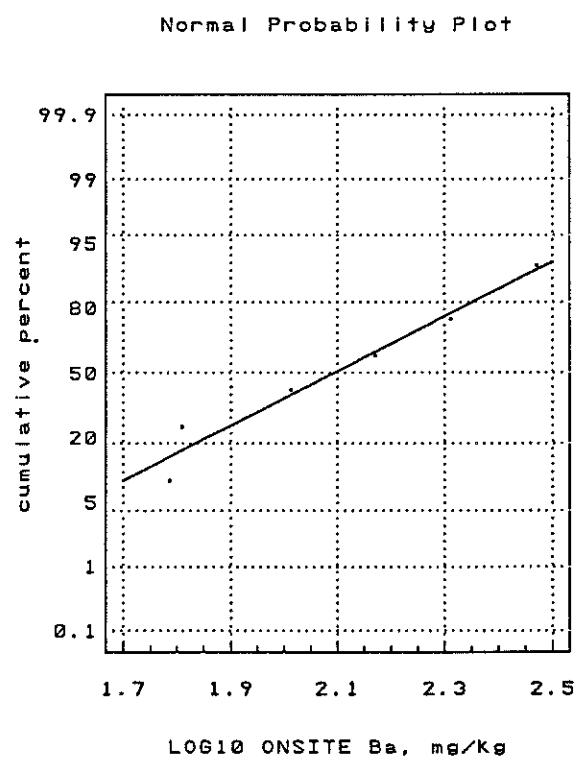
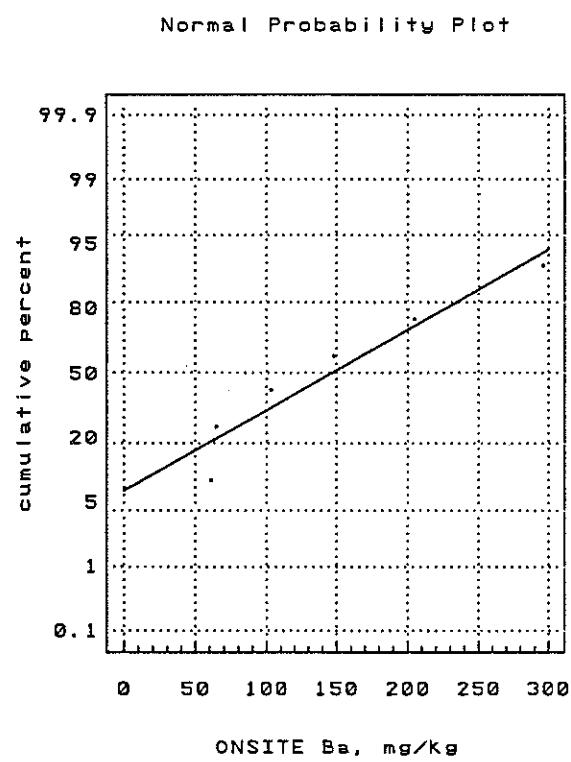
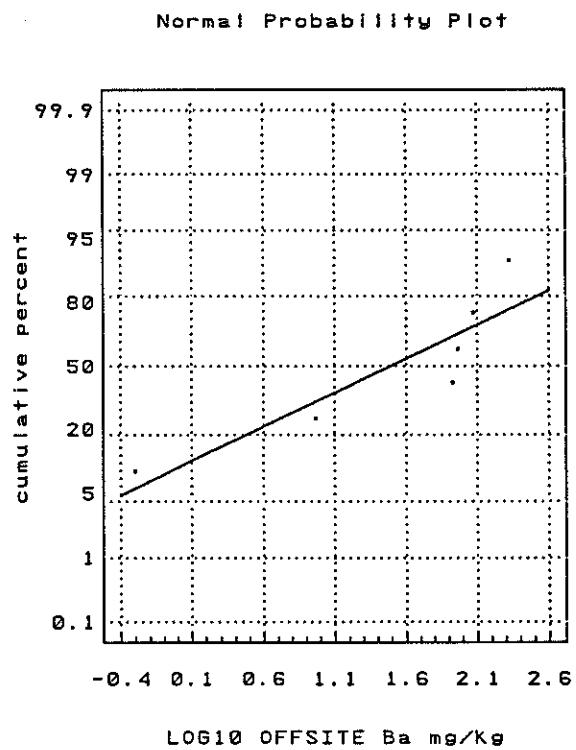
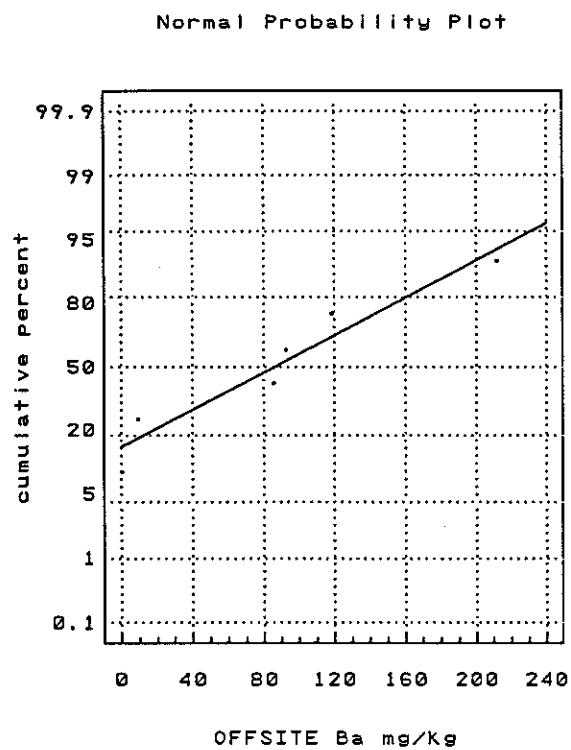


FIG.2e PROBABILITY PLOTS FOR ONSITE AND OFFSITE BARIUM.

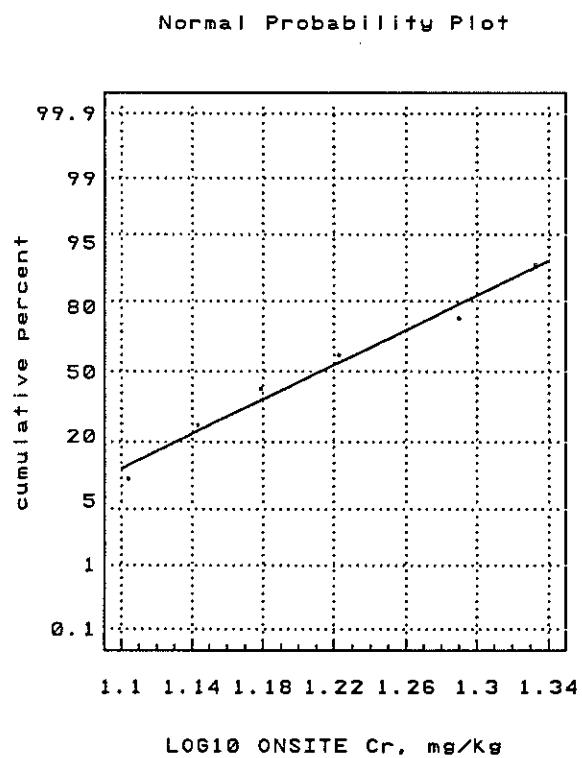
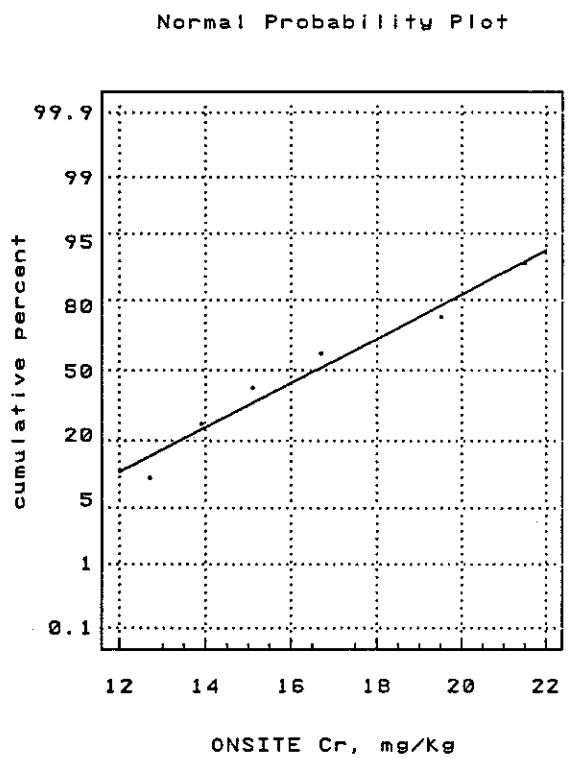
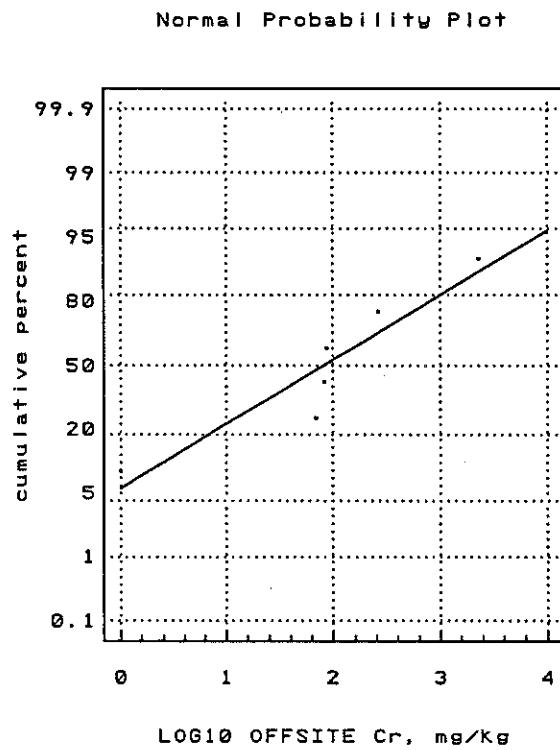
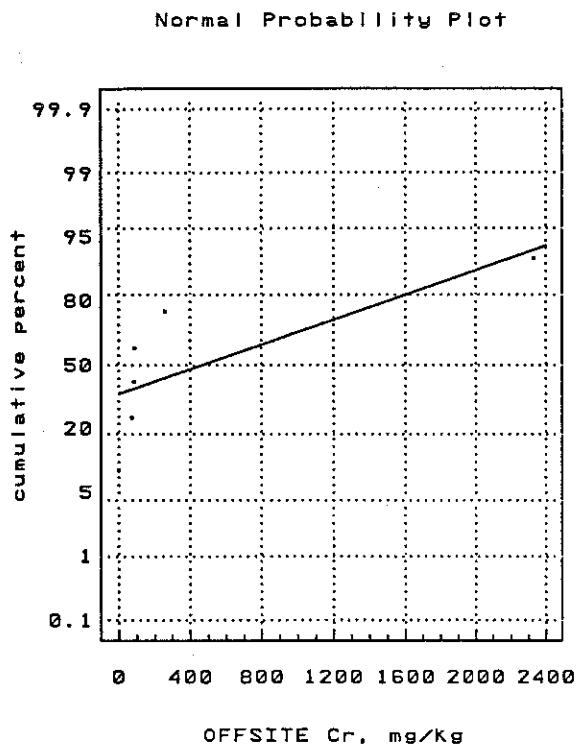


Fig 2b - Normal and Lognormal probability plots for onsite and offsite Chromium

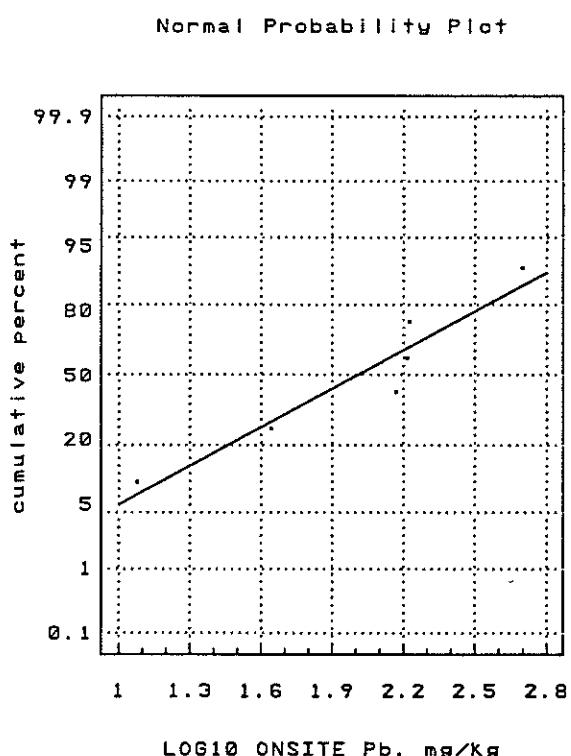
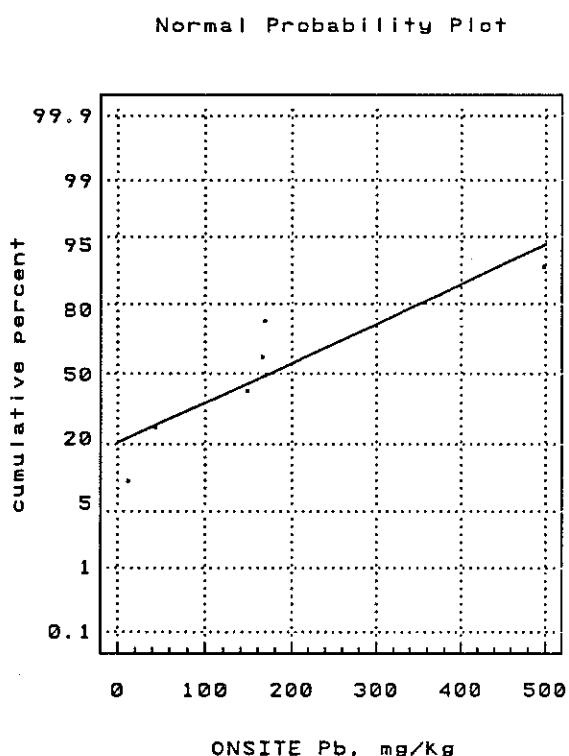
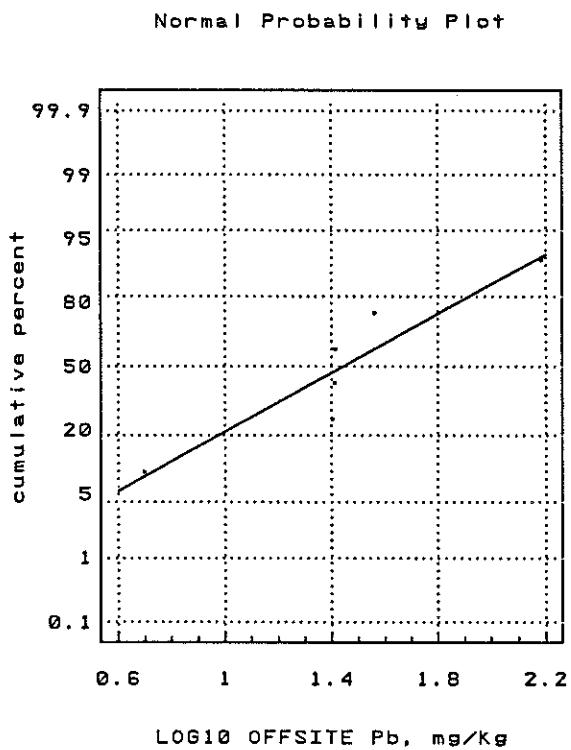
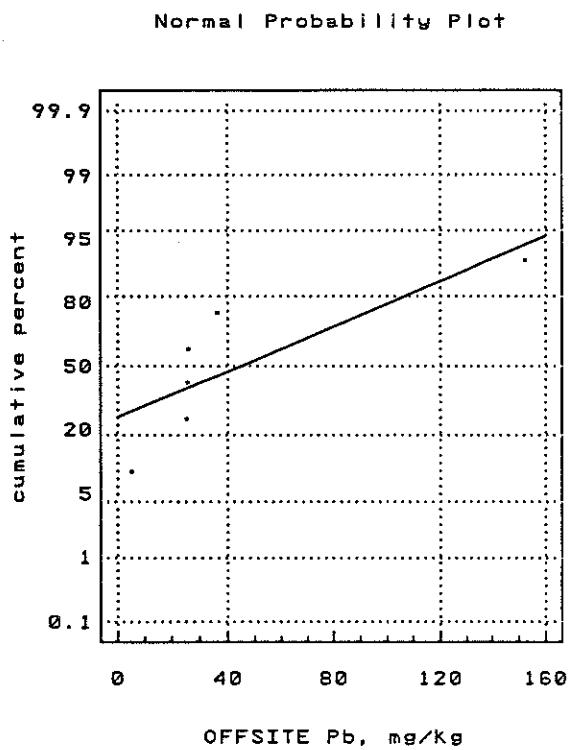


Fig 2c - Normal and lognormal Probability Plots for offsite and onsite lead.

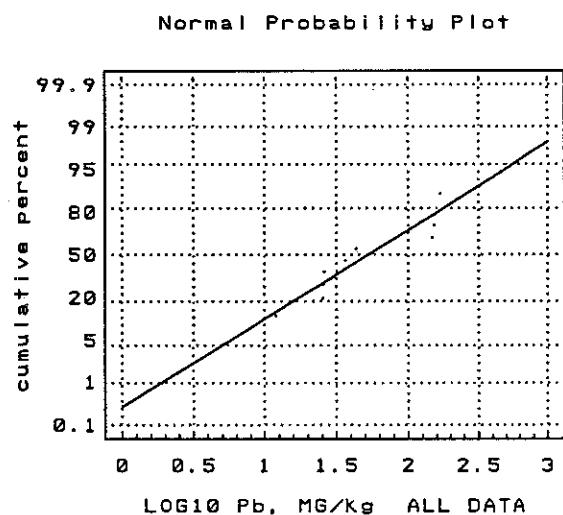
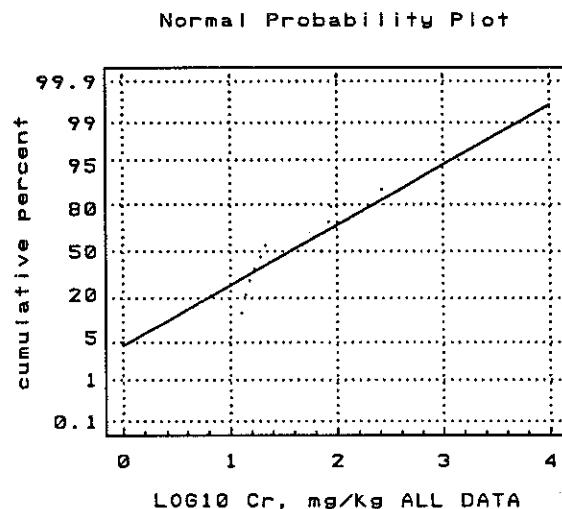
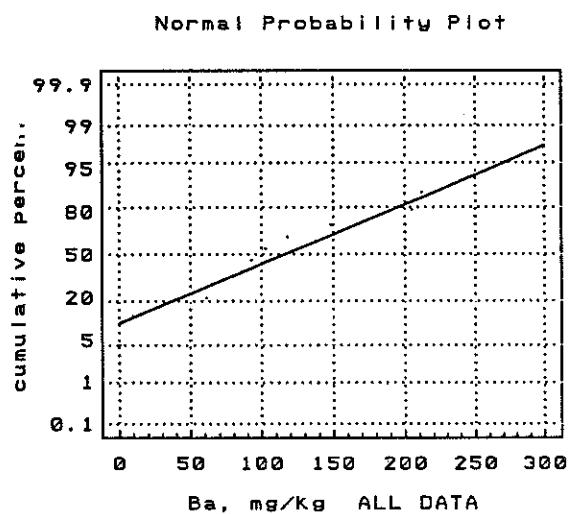


Fig 3 - Selected Probability Plots for all data - Barium - normal, Chromium - log normal and lead - log-normal .

RMT REPORT
AMERICAN STEEL FOUNDRIES

NOVEMBER 1993

Appendix A
LABORATORY RESULTS



ENSECO-WADSWORTH/ALERT Laboratories

Division of Corning Lab Services, Inc.

Corporate and Laboratory:

4101 Shuffel Drive, NW 216-497-9396
North Canton, OH 44720 FAX 216-497-0772

ANALYTICAL REPORT

PROJECT NO. 2169.15

ASF-ALLIANCE, OH

LYNN HALL

RMT

ENSECO-WADSWORTH/ALERT LABORATORIES

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September 15, 1993

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PROJECT NARRATIVE

The following report contains the analytical results for twelve solid samples and one Quality Control sample submitted to Enseco-Wadsworth/ALERT Laboratories by RMT from the ASF-Alliance, OH Site project number 2169.15. The samples were received August 30, 1993, according to documented sample acceptance procedures.

Enseco-Wadsworth/ALERT Laboratories utilizes only USEPA approved methods and instrumentation in all analytical work. The samples presented in this report were analyzed for the parameters listed on the following page in accordance with the methods indicated. A summary of QC data for these analyses is included at the end of the report.

ANALYTICAL METHODS SUMMARY

Enseco-Wadsworth/ALERT Laboratories utilizes only USEPA approved methods in analytical work. The methods used for the analyses presented in the following report are listed below.

<u>Parameters</u>	<u>Methods</u>
Barium	SW846 6010
Cadmium	SW846 6010
Chromium	SW846 6010
Lead	SW846 6010
Solids, Total (TS)	MCAWW 160.3 MODIFIED

References:

- MCAWW Methods for Chemical Analysis of Water and Wastes, EMSL:
 Cincinnati, OH: March 1983 and its updates.
- SW846 "Test Methods for Evaluating Solid Waste, Physical/Chemical
 Methods", Third Edition, September, 1986.

SAMPLE SUMMARY

The analytical results of the samples listed below are presented on the following pages.

<u>WO #</u>	<u>LABORATORY ID</u>	<u>SAMPLE IDENTIFICATION</u>
F6344	A3H300028-001	11 8-30-93 1005
F6345	A3H300028-002	12 8-30-93 1100
F6346	A3H300028-003	09 8-30-93 1115
F6347	A3H300028-004	10 8-30-93 1130
F6348	A3H300028-005	08 8-30-93 1145
F6349	A3H300028-006	07 8-30-93 1200
F6350	A3H300028-007	DUP 8-30-93 1210
F6351	A3H300028-008	03 8-30-93 1220
F6352	A3H300028-009	04 8-30-93 1235
F6353	A3H300028-010	06 8-30-93 1240
F6354	A3H300028-011	05 8-30-93 1250
F6355	A3H300028-012	02 8-30-93 1310
F6356	A3H300028-013	01 8-30-93 1320

RMT

11 8-30-93 1005

WO #: F6344
LAB #: A3H300028-001
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING <u>LIMIT</u>	UNIT	METHOD	PREPARATION - <u>ANALYSIS DATE</u>	QC <u>BATCH</u>
Barium	9.3	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Chromium	69.9	2.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Lead	25.3	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

11 8-30-93 1005

WO #: F6344
LAB #: A3H300028-001
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	87.2	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251048

NOTE: AS RECEIVED

RMT

12 8-30-93 1100

WO #: F6345
LAB #: A3H300028-002
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Barium	85.5	5.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Chromium	2,330	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Lead	25.7	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

12 8-30-93 1100

WO #: F6345
LAB #: A3H300028-002
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	93.8	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251048

NOTE: AS RECEIVED

RMT

09 8-30-93 1115

WO #: F6346
LAB #: A3H300028-003
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING			<u>METHOD</u>	<u>PREPARATION</u>	<u>QC</u>
		<u>LIMIT</u>	<u>UNIT</u>	<u>ANALYSIS DATE</u>		<u>BATCH</u>	
Barium	212	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Chromium	87.6	2.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Lead	25.9	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

09 8-30-93 1115

WO #: F6346
LAB #: A3H300028-003
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	84.6	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251048

NOTE: AS RECEIVED

RMT

10 8-30-93 1130

WO #: F6347
LAB #: A3H300028-004
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Barium	92.8	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Chromium	260	2.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Lead	36.3	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

10 8-30-93 1130

WO #: F6347
LAB #: A3H300028-004
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	89.6	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251057

NOTE: AS RECEIVED

RMT

08 8-30-93 1145

WO #: F6348
LAB #: A3H300028-005
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING		<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
		<u>LIMIT</u>	<u>UNIT</u>			
Barium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Chromium	ND	2.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Lead	ND	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

08 8-30-93 1145

WO #: F6348
LAB #: A3H300028-005
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	88.6	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251057

NOTE: AS RECEIVED

RMT

07 8-30-93 1200

WO #: F6349
LAB #: A3H300028-006
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING			<u>METHOD</u>	PREPARATION -		<u>QC</u> <u>BATCH</u>
		<u>LIMIT</u>	<u>UNIT</u>			<u>ANALYSIS DATE</u>		
Barium	119	1.0	mg/kg	SW846 6010	9/08-	9/10/93	3251008	
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08-	9/10/93	3251008	
Chromium	69.3	2.0	mg/kg	SW846 6010	9/08-	9/10/93	3251008	
Lead	63.6	10.0	mg/kg	SW846 6010	9/08-	9/10/93	3251008	

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

07 8-30-93 1200

WO #: F6349
LAB #: A3H300028-006
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	87.6	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251057

NOTE: AS RECEIVED

RMT

DUP 8-30-93 1210

WO #: F6350
LAB #: A3H300028-007
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING			<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
		<u>LIMIT</u>	<u>UNIT</u>				
Barium	118	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Chromium	97.0	2.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Lead	241	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

DUP 8-30-93 1210

WO #: F6350
LAB #: A3H300028-007
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	91.1	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251057

NOTE: AS RECEIVED

RMT

03 8-30-93 1220

WO #: F6351
LAB #: A3H300028-008
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING			<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
		<u>LIMIT</u>	<u>UNIT</u>				
Barium	148	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Chromium	12.7	2.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Lead	148	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

03 8-30-93 1220

WO #: F6351
LAB #: A3H300028-008
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	86.3	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251057

NOTE: AS RECEIVED

RMT

04 8-30-93 1235

WO #: F6352
LAB #: A3H300028-009
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Barium	103	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Chromium	16.7	2.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Lead	16.8	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

04 8-30-93 1235

WO #: F6352
LAB #: A3H300028-009
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	85.6	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251057

NOTE: AS RECEIVED

RMT

06 8-30-93 1240

WO #: F6353
LAB #: A3H300028-010
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING			<u>METHOD</u>	PREPARATION -		<u>QC</u>	<u>BATCH</u>
		<u>LIMIT</u>	<u>UNIT</u>			<u>ANALYSIS DATE</u>			
Barium	296	1.0	mg/kg	SW846 6010	9/08-	9/10/93	3251008		
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08-	9/10/93	3251008		
Chromium	19.5	2.0	mg/kg	SW846 6010	9/08-	9/10/93	3251008		
Lead	498	10.0	mg/kg	SW846 6010	9/08-	9/10/93	3251008		

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

06 8-30-93 1240

WO #: F6353
LAB #: A3H300028-010
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	87.5	0.50	%	MCANW 160.3	9/08- 9/09/93	3251057

NOTE: AS RECEIVED

RMT

05 8-30-93 1250

WO #: F6354
LAB #: A3H300028-011
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Barium	61.1	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Chromium	15.1	2.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008
Lead	12.0	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

05 8-30-93 1250

WO #: F6354
LAB #: A3H300028-011
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>QC BATCH</u>
Solids, Total (TS)	85.3	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251057

NOTE: AS RECEIVED

RMT

02 8-30-93 1310

WO #: F6355
LAB #: A3H300028-012
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING			<u>METHOD</u>	PREPARATION -		<u>QC</u>
		<u>LIMIT</u>	<u>UNIT</u>			<u>ANALYSIS DATE</u>	<u>BATCH</u>	
Barium	64.6	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008		
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008		
Chromium	13.9	2.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008		
Lead	43.6	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008		

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

02 8-30-93 1310

WO #: F6355
LAB #: A3H300028-012
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	REPORTING			<u>METHOD</u>	<u>PREPARATION -</u> <u>ANALYSIS DATE</u>	<u>QC</u> <u>BATCH</u>
	<u>RESULT</u>	<u>LIMIT</u>	<u>UNIT</u>			
Solids, Total (TS)	67.9	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251057

NOTE: AS RECEIVED

RMT

01 8-30-93 1320

WO #: F6356
LAB #: A3H300028-013
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - REQUESTED METALS - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING		<u>METHOD</u>	PREPARATION -		<u>QC</u>
		<u>LIMIT</u>	<u>UNIT</u>		<u>ANALYSIS DATE</u>	<u>BATCH</u>	
Barium	205	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Chromium	21.5	2.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	
Lead	165	10.0	mg/kg	SW846 6010	9/08- 9/10/93	3251008	

NOTE:

AS RECEIVED

ND NOT DETECTED AT THE STATED REPORTING LIMIT

RMT

01 8-30-93 1320

WO #: F6356
LAB #: A3H300028-013
MATRIX: SOLID

DATE RECEIVED: 8/30/93

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING <u>LIMIT</u>	UNIT	<u>METHOD</u>	<u>PREPARATION -</u> <u>ANALYSIS DATE</u>	QC <u>BATCH</u>
Solids, Total (TS)	89.8	0.50	%	MCAWW 160.3	9/08- 9/09/93	3251057

NOTE: AS RECEIVED

QUALITY CONTROL SECTION

QUALITY CONTROL NARRATIVE

The results included in this report have been reviewed for compliance with the laboratory QA/QC plan. All data have been found to be compliant with the exception of those items noted.

The matrix spike and matrix spike duplicate (MS/MSD) contained in this quality control report were generated as part of the laboratory QA/QC program requirements. These requirements include the analysis of a MS/MSD on a one in twenty basis. Therefore, the associated batch number indicated on the MS/MSD report may not reflect the same batch number as those of the samples contained in the analytical report.

CHECK SAMPLE REPORT

LAB #: A3H300028

- - - - - METALS - - - - -

COMPOUND	SPIKE PERCENT RECOVERY	Q/C LIMITS	PREPARATION - ANALYSIS DATE
BATCH: 3251008 MATRIX: SOLID			
Barium	95	(82-112)	9/08- 9/10/93
Cadmium	89	(72-109)	9/08- 9/10/93
Chromium	94	(76-118)	9/08- 9/10/93
Lead	92	(78-112)	9/08- 9/10/93

CHECK SAMPLE REPORT

LAB #: A3H300028

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>COMPOUND</u>	<u>SPIKE PERCENT RECOVERY</u>	<u>LIMITS</u>	<u>MATRIX</u>	<u>PREPARATION - ANALYSIS DATE</u>	<u>Q/C BATCH</u>
Solids, Total (TS)	98	(89-110)	SOLID	9/08- 9/09/93	3251048
Solids, Total (TS)	102	(89-110)	SOLID	9/08- 9/09/93	3251057

INTRA-LAB BLANK REPORT

LAB #: A3H300028

----- METALS -----

<u>PARAMETER</u>	<u>RESULT</u>	<u>REPORTING LIMIT</u>	<u>UNIT</u>	<u>METHOD</u>	<u>PREPARATION - ANALYSIS DATE</u>
BATCH: 3251008 MATRIX: SOLID					
Barium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93
Cadmium	ND	1.0	mg/kg	SW846 6010	9/08- 9/10/93
Chromium	ND	2.0	mg/kg	SW846 6010	9/08- 9/10/93
Lead	ND	10.0	mg/kg	SW846 6010	9/08- 9/10/93

NOTE:

ND NOT DETECTED AT THE STATED REPORTING LIMIT

INTRA-LAB BLANK REPORT

LAB #: A3H300028

- - - - - INORGANIC ANALYTICAL REPORT - - - - -

<u>PARAMETER</u>	<u>RESULT</u>	REPORTING			PREPARATION -	QC
		<u>LIMIT</u>	<u>UNIT</u>	<u>MATRIX</u>	<u>ANALYSIS DATE</u>	<u>BATCH</u>
Solids, Total (TS)	ND	0.50	%	SOLID	9/08- 9/09/93	3251048
Solids, Total (TS)	ND	0.50	%	SOLID	9/08- 9/09/93	3251057

NOTE:

ND NOT DETECTED AT THE STATED REPORTING LIMIT

MATRIX SPIKE REPORT

SOLID - ICP

- - - - - METALS - - - - -

COMPOUND	SPIKE PERCENT RECOVERY	SPIKE/DUP PERCENT RECOVERY	Q/C LIMITS	RPD	RPD LIMITS	PREPARATION- ANALYSIS DATE	W/O#
Silver	87	86	(60-110)	2	(0-20)	7/15-7/25/93	E5241
Aluminum	108	98	(56-138)	10	(0-20)	7/08-7/09/93	E4621
Boron	73	75	(66-122)	3	(0-20)	6/10-6/23/93	D9278
Barium	88	87	(15-151)	2	(0-20)	7/15-7/25/93	E5241
Beryllium	86	87	(68-110)	1	(0-20)	7/15-7/25/93	E5241
Calcium	91	90	(64-126)	1	(0-20)	7/15-7/25/93	E5241
Cadmium	88	86	(65-110)	2	(0-20)	7/15-7/25/93	E5241
Cobalt	91	90	(57-108)	1	(0-20)	7/15-7/25/93	E5241
Chromium	88	86	(56-114)	2	(0-20)	7/15-7/25/93	E5241
Copper	88	91	(62-115)	3	(0-20)	7/18-7/26/93	E6162
Iron	94	79	(59-120)	17	(0-20)	7/15-7/25/93	E5241
Potassium	93	91	(10-170)	2	(0-20)	7/15-7/25/93	E5241
Magnesium	98	93	(66-117)	5	(0-20)	7/15-7/25/93	E5241
Manganese	88	85	(10-184)	4	(0-20)	7/15-7/25/93	E5241
Sodium	92	91	(23-140)	1	(0-20)	7/15-7/25/93	E5241
Nickel	79	79	(57-114)	0	(0-20)	7/15-7/25/93	E5241
Lead	83	86	(36-137)	4	(0-20)	7/15-7/25/93	E5241
Antimony	48	47	(10-125)	3	(0-20)	7/15-7/25/93	E5241
Strontium	90	91	(10-125)	1	(0-20)	6/10-6/23/93	D9278
Tin	83	88	(59-115)	6	(0-20)	6/10-6/23/93	D9278
Titanium	102	101	(80-111)	1	(0-20)	5/04-5/07/93	D0765
Thallium	71	74	(57-116)	4	(0-20)	7/26-7/26/93	E5241
Vanadium	100	99	(66-117)	1	(0-20)	7/15-7/25/93	E5241
Zinc	81	77	(36-130)	5	(0-20)	7/15-7/25/93	E5241
Gold	103	102	(70-130)	1	(0-20)	11/30-12/01/92	A3214
Arsenic	91	94	(50-152)	3	(0-20)	4/19-4/21/93	C7259
Selenium	89	101	(50-110)	13	(0-20)	4/19-4/21/93	C7259
Molybdenum	82	83	(78-114)	1	(0-20)	6/10-6/23/93	D9278

CLIENT CODE _____

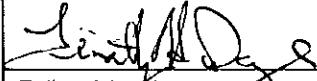
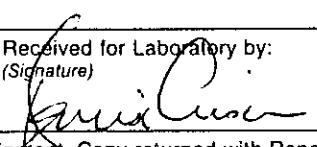
QUOTE / SAR NUMBER _____

Chain-of Custody Record

1) ENSECO-WADSWORTH/ALERT LABORATORIES
DIVISION OF CORNING LAB SERVICES, INC.
4101 SHUFFEL DR. N.W.
NORTH CANTON, OHIO 44720
PHONE (216) 497-9396 FAX (216) 497-0772

2) ENSECO-WADSWORTH/ALERT LABORATORIES
DIVISION OF CORNING LAB SERVICES, INC.
450 WILLIAM PITTS WAY
PITTSBURGH, PA 15238
PHONE (412) 826-5477 FAX (412) 826-5571

3) ENSECO-WADSWORTH/ALERT LABORATORIES
DIVISION OF CORNING LAB SERVICES, INC.
5910 BRECKENRIDGE PKWY., STE. H
TAMPA, FL 33610
PHONE (813) 621-0784 FAX (813) 623-6021

PROJ. NO.		PROJECT NAME/LOCATION				NO. OF CONTAINERS	PARAMETER						REMARKS
STA. NO.	DATE	TIME	COMP.	GRAB.	STATION LOCATION		1 st	2 nd	3 rd	4 th	5 th	6 th	
11	8/30/93	1005	X		11	X	X	X	X				
12	8/30/93	1100	X		12	X	X	X	X				
09	8/30/93	1115	X		09	X	X	X	X				
10	8/30/93	1130	X		10	X	X	X	X				
08	8/30/93	1145	X		08	X	X	X	X				
07	8/30/93	1200	X		07	X	X	X	X				
DUP	8/30/93	1210	X		DUP	X	X	X	X				
03	8/30/93	1220	X		03	X	X	X	X				
04	8/30/93	1235	X		04	X	X	X	X				
06	8/30/93	1240	X		06	X	X	X	X				
05	8/30/93	1250	X		05	X	X	X	X				
02	8/30/93	1310	X		02	X	X	X	X				
01	8/30/93	1320	X		01	X	X	X	X				
Relinquished by: (Signature)		Date / Time	Received by: (Signature)			Relinquished by: (Signature)			Date / Time	Received by: (Signature)			
		8/30/93 3 ²⁰ pm											
Relinquished by: (Signature)		Date / Time	Received by: (Signature)			Relinquished by: (Signature)			Date / Time	Received by: (Signature)			
Relinquished by: (Signature)		Date / Time	Received for Laboratory by: (Signature)			Date / Time		Remarks	CLIENT - RNT				
						8/30/93 3 ²⁰							
Distribution Original Accompanies Shipment. Copy returned with Report.													

RMT REPORT
AMERICAN STEEL FOUNDRIES

NOVEMBER 1993

**Appendix B
STATISTICAL WORKSHEETS**

Appendices :

A-1

Two-Sample Analysis Results

	HALL.BaOFF	HALL.BaON	Pooled
Sample Statistics: Number of Obs.	6	6	12
Average	86.4333	146.283	116.358
Variance	6034.15	8333.5	7183.82
Std. Deviation	77.6798	91.288	84.7574
Median	89.15	125.5	97.9

Difference between Means = -59.85

Conf. Interval For Diff. in Means:

(Equal Vars.)	Sample 1 - Sample 2	-168.912 49.2125	10 D.F.
(Unequal Vars.)	Sample 1 - Sample 2	-169.292 49.5924	9.8 D.F.

Ratio of Variances = 0.724084

Conf. Interval for Ratio of Variances:

Sample 1 - Sample 2	95 Percent 0.101322 5.17458	5 5 D.F.
---------------------	--------------------------------	----------

Hypothesis Test for H0: Diff = 0
vs Alt: NE
at Alpha = 0.05

Computed t statistic = -1.22306
Sig. Level = 0.249348
so do not reject H0.

116.358

111.757
119.514
169.358
116.972
785.972
= 281
50
58
57

BARIUM
LOG TRANSFORMED

Two-Sample Analysis Results

		Sample 1	Sample 2	Pooled
Sample Statistics:	Number of Obs.	6	6	12
	Average	1.4945	2.09374	1.79412
	Variance	0.988644	0.0755062	0.532075
	Std. Deviation	0.994306	0.274784	0.729435
	Median	1.94976	2.09155	1.99019

Difference between Means = -0.599233

Conf. Interval For Diff. in Means:
 (Equal Vars.) Sample 1 - Sample 2 -1.53784 0.339374 10 D.F.
 (Unequal Vars.) Sample 1 - Sample 2 -1.64057 0.442108 5.8 D.F.

Ratio of Variances = 13.0935

Conf. Interval for Ratio of Variances:
 Sample 1 - Sample 2 95 Percent
 1.83219 93.5714 5 5 D.F.

Hypothesis Test for H0: Diff = 0
 vs Alt: NE
 at Alpha = 0.05 Computed t statistic = -1.42289
 Sig. Level = 0.185208
 so do not reject H0.

Two-Sample Analysis Results

	HALL.CrOFF	HALL.CrON	Pooled
Sample Statistics: Number of Obs.	6	6	12
Average	471.942	16.5667	244.254
Variance	835920	11.4347	417966
Std. Deviation	914.287	3.38152	646.503
Median	85.375	15.9	20.5

Difference between Means = 455.375

Conf. Interval For Diff. in Means:
 (Equal Vars.) Sample 1 - Sample 2 95 Percent
 (Unequal Vars.) Sample 1 - Sample 2 -376.519 1287.27 10 D.F.
 -504.419 1415.17 5.0 D.F.

Ratio of Variances = 73104

Conf. Interval for Ratio of Variances:
 Sample 1 - Sample 2 95 Percent
 10229.5 522429 5 5 D.F.

Hypothesis Test for H0: Diff = 0
 vs Alt: NE
 at Alpha = 0.05

Computed t statistic = 1.22
 Sig. Level = 0.250456
 so do not reject H0.

$$\begin{array}{r}
 914.3 \\
 182.8 \\
 172.0 \\
 230.0 \\
 \hline
 471.9 + 2(914.3) = 2300
 \end{array}$$

$$\begin{array}{r}
 3.38 \\
 1.674 \\
 1.657 \\
 2.33 \\
 \hline
 1.244.24
 \end{array}$$

$$\begin{array}{r}
 646.5 \\
 129.3 \\
 \hline
 1243.724
 \end{array}$$

$$\begin{array}{r}
 1.244.24 \\
 1.243.724 \\
 \hline
 1.537.24
 \end{array}$$

CHROMIUM
LOG TRANSFORMED
Two-Sample Analysis Results

	Sample 1	Sample 2	Pooled
Sample Statistics: Number of Obs.	6	6	12
Average	1.91486	1.21183	1.56335
Variance	1.20646	0.00765308	0.607055
Std. Deviation	1.09839	0.0874819	0.779138
Median	1.93118	1.20085	1.31124

Difference between Means = 0.703031

Conf. Interval For Diff. in Means:

(Equal Vars.)	Sample 1 - Sample 2	95 Percent	10 D.F.
(Unequal Vars.)	Sample 1 - Sample 2	-0.299532 1.70559	5.1 D.F.
		-0.449334 1.8554	

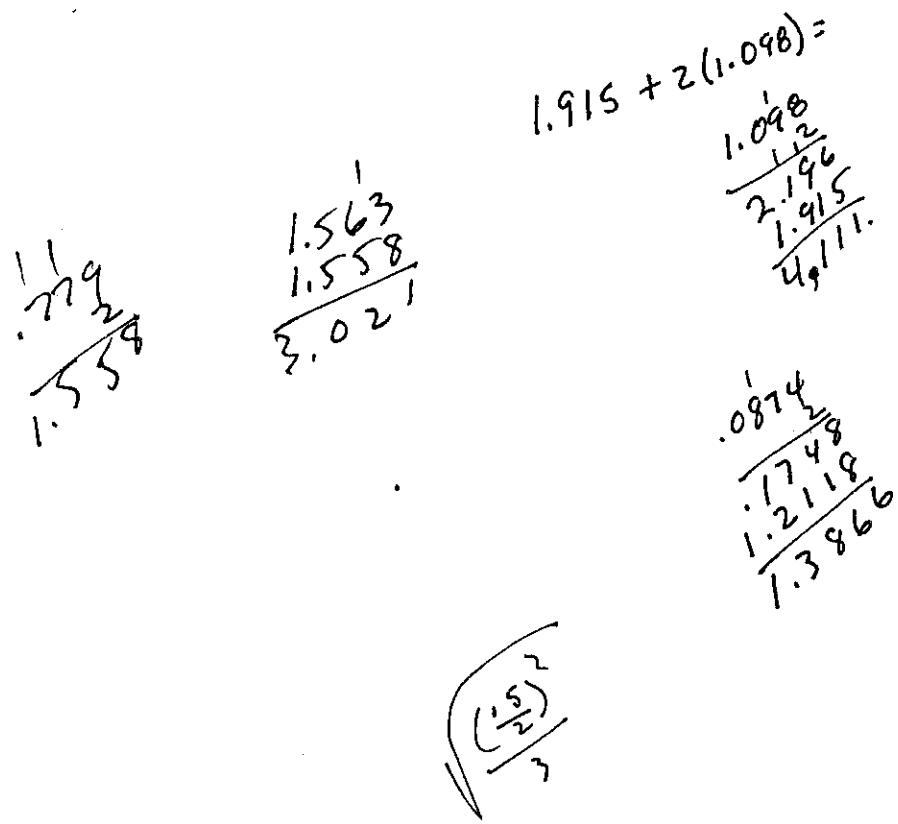
Ratio of Variances = 157.643

Conf. Interval for Ratio of Variances:

Sample 1 - Sample 2	95 Percent	5	5 D.F.
	22.0592 1126.58		

Hypothesis Test for H0: Diff = 0
 vs Alt: NE
 at Alpha = 0.05

Computed t statistic = 1.56286
 Sig. Level = 0.149149
 so do not reject H0.



Two-Sample Analysis Results

	HALL.PbOFF	HALL.PbON	Pooled
Sample Statistics: Number of Obs.	6	6	12
Average	45.0833	172.433	108.758
Variance	2862.87	29800.5	16331.7
Std. Deviation	53.5058	172.628	127.795
Median	25.8	156.5	39.95

Difference between Means = -127.35

Conf. Interval For Diff. in Means:

(Equal Vars.)	Sample 1 - Sample 2	95 Percent	10 D.F.
(Unequal Vars.)	Sample 1 - Sample 2	-291.792 37.092	6.0 D.F.

Ratio of Variances = 0.0960677

Conf. Interval for Ratio of Variances:

Sample 1 - Sample 2	95 Percent	5	5 D.F.
	0.0134429 0.686537		

Hypothesis Test for H0: Diff = 0
 vs Alt: NE
 at Alpha = 0.05

Computed t statistic = -1.72601

Sig. Level = 0.115052
 so do not reject H0.

53.5
107.0

45.08
107.00
152.08
172.62
345.2
372.4
517.6
27.8
255.6
108.7
255.6
364.3

Pb
LOG TRANSFORMED
Two-Sample Analysis Results

	Sample 1	Sample 2	Pooled
Sample Statistics: Number of Obs.	6	6	12
Average	1.44465	2.00483	1.72474
Variance	0.223591	0.318184	0.270887
Std. Deviation	0.472854	0.564078	0.520468
Median	1.41162	2.19387	1.5997

Difference between Means = -0.56017

Conf. Interval For Diff. in Means:

(Equal Vars.)	Sample 1 - Sample 2	95 Percent
(Unequal Vars.)	Sample 1 - Sample 2	-1.22989 0.109547 10 D.F.
		-1.23267 0.112326 9.7 D.F.

Ratio of Variances = 0.702709

Conf. Interval for Ratio of Variances:

Sample 1 - Sample 2	95 Percent
	0.0983308 5.02183 5 5 D.F.

Hypothesis Test for H0: Diff = 0
 vs Alt: NE
 at Alpha = 0.05

Computed t statistic = -1.86417
 Sig. Level = 0.0918831
 so do not reject H0.

~~1.73~~
~~1.22~~
~~1.94~~
~~1.44~~
~~1.39~~
~~2.12~~ .564
~~1.28~~
~~1.13~~
~~2.005~~
~~1.128~~
~~3.133~~
~~1.725~~
~~1.04~~
~~2.765~~

One-Sample Analysis Results

	HALL.BaALL
Sample Statistics: Number of Obs.	12
Average	116.358
Variance	7507.66
Std. Deviation	86.6468
Median	97.9
Confidence Interval for Mean:	95 Percent
Sample 1	61.2912 171.425
Confidence Interval for Variance:	95 Percent
Sample 1	3767.52 21643.6
Hypothesis Test for H0: Mean = 0 vs Alt: NE at Alpha = 0.05	Computed t statistic = 4.65196 Sig. Level = 0.000702842 so reject H0.

One-Sample Analysis Results

	LOG10 HALL.BaALL
Sample Statistics: Number of Obs.	12
Average	1.79412
Variance	0.581635
Std. Deviation	0.76265
Median	1.99019
Confidence Interval for Mean:	95 Percent
Sample 1	1.30943 2.27881
Confidence Interval for Variance:	95 Percent
Sample 1	0.291878 1.67678
Hypothesis Test for H0: Mean = 0 vs Alt: NE at Alpha = 0.05	Computed t statistic = 8.14923 Sig. Level = 0.0000054771 so reject H0.

One-Sample Analysis Results

	HALL.CrALL
Sample Statistics: Number of Obs.	12
Average	244.254
Variance	436523
Std. Deviation	660.699
Median	20.5
Confidence Interval for Mean:	95 Percent
Sample 1	-175.644 664.152
Confidence Interval for Variance:	95 Percent
Sample 1	219058 1.25844E6
Hypothesis Test for H0: Mean = 0 vs Alt: NE at Alpha = 0.05	Computed t statistic = 1.28065 Sig. Level = 0.226662 so do not reject H0.

One-Sample Analysis Results

	LOG10 HALL.CrALL
Sample Statistics: Number of Obs.	12
Average	1.56335
Variance	0.686665
Std. Deviation	0.828652
Median	1.31124
Confidence Interval for Mean:	95 Percent
Sample 1	1.03671 2.08999
Confidence Interval for Variance:	95 Percent
Sample 1	0.344585 1.97957
Hypothesis Test for H0: Mean = 0 vs Alt: NE at Alpha = 0.05	Computed t statistic = 6.53542 Sig. Level = 0.0000421851 so reject H0.

One-Sample Analysis Results

	HALL.PbALL
Sample Statistics: Number of Obs.	12
Average	108.758
Variance	19270.1
Std. Deviation	138.817
Median	39.95
Confidence Interval for Mean:	95 Percent
Sample 1	20.5353 196.981
Confidence Interval for Variance:	95 Percent
Sample 1	9670.18 55553.1
Hypothesis Test for H0: Mean = 0 vs Alt: NE at Alpha = 0.05	Computed t statistic = 2.71401 Sig. Level = 0.0201462 so reject H0.

One-Sample Analysis Results

Sample Statistics:	Number of Obs.	LOG10 HALL.PbALL
	Average	12
	Variance	1.72474
	Std. Deviation	0.33184
	Median	0.576056
Confidence Interval for Mean:	95 Percent	
Sample 1	1.35864	2.09084
Confidence Interval for Variance:	95 Percent	
Sample 1	0.166525	0.956653
Hypothesis Test for H0: Mean = 0	Computed t statistic = 10.3717	
vs Alt: NE	Sig. Level = 5.12772E-7	
at Alpha = 0.05	so reject H0.	

Distribution Fitting

Data: HALL.BaOFF

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 14

Mean: 86.4333

Standard deviation: 77.6798

Offsite Barum - Normal

Estimated KOLMOGOROV statistic DPLUS = 0.173206
Estimated KOLMOGOROV statistic DMINUS = 0.161871
Estimated overall statistic DN = 0.173206
Approximate significance level = 0.993764

Distribution Fitting

Data: HALL.BaOFF

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 13

Mean: 429.261

Standard deviation: 5885.55

LOG TRANSFORMED
B_a OFF

Estimated KOLMOGOROV statistic DPLUS = 0.201409
Estimated KOLMOGOROV statistic DMINUS = 0.336688
Estimated overall statistic DN = 0.336688
Approximate significance level = 0.504506

Distribution Fitting

Data: HALL.BaON

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 14

Mean: 146.283

Standard deviation: 91.288

NORMAL
Ba ON

Estimated KOLMOGOROV statistic DPLUS = 0.1823
Estimated KOLMOGOROV statistic DMINUS = 0.175377
Estimated overall statistic DN = 0.1823
Approximate significance level = 0.988459

Distribution Fitting

Data: HALL.BaON

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 13

Mean: 151.588

Standard deviation: 106.362

LOG NORMAL

Ba ON

Estimated KOLMOGOROV statistic DPLUS = 0.182233
Estimated KOLMOGOROV statistic DMINUS = 0.131407
Estimated overall statistic DN = 0.182233
Approximate significance level = 0.988508

Distribution Fitting

Data: HALL.CrOFF

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 14

Mean: 471.942

Standard deviation: 914.287

NORMAL

OR OFF

Estimated KOLMOGOROV statistic DPLUS = 0.424993
Estimated KOLMOGOROV statistic DMINUS = 0.303243
Estimated overall statistic DN = 0.424993
Approximate significance level = 0.228599

Distribution Fitting

Data: HALL.CrOFF

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 13

Mean: 2013.02

Standard deviation: 49257.4

LOG NORMAL

Cr OFF

Estimated KOLMOGOROV statistic DPLUS = 0.157774
Estimated KOLMOGOROV statistic DMINUS = 0.307784
Estimated overall statistic DN = 0.307784
Approximate significance level = 0.620584

Distribution Fitting

Data: HALL.CrON

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 14

Mean: 16.5667

Standard deviation: 3.38152

NORMAL
Cr ON

Estimated KOLMOGOROV statistic DPLUS = 0.167763
Estimated KOLMOGOROV statistic DMINUS = 0.140487
Estimated overall statistic DN = 0.167763
Approximate significance level = 0.995903

Distribution Fitting

Data: HALL.CrON

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 13

Mean: 16.6204

Standard deviation: 3.38217

LOGNORMAL
2r ON

Estimated KOLMOGOROV statistic DPLUS = 0.146375
Estimated KOLMOGOROV statistic DMINUS = 0.147659
Estimated overall statistic DN = 0.147659
Approximate significance level = 0.999444

Distribution Fitting

Data: HALL.PbOFF

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 14

Mean: 45.0833

Standard deviation: 53.5058

Normal
Pb OFF

Estimated KOLMOGOROV statistic DPLUS = 0.398532
Estimated KOLMOGOROV statistic DMINUS = 0.226885
Estimated overall statistic DN = 0.398532
Approximate significance level = 0.296391

Distribution Fitting

Data: HALL.PbOFF

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 13

Mean: 50.3586

Standard deviation: 75.9091

~~MR~~ LOGNORMAL
Pb.OFF

Estimated KOLMOGOROV statistic DPLUS = 0.237049
Estimated KOLMOGOROV statistic DMINUS = 0.298333
Estimated overall statistic DN = 0.298333
Approximate significance level = 0.6596

Distribution Fitting

Data: HALL.PbON

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 14

Mean: 172.433

Standard deviation: 172.628

NORMAL
P6 ON

Estimated KOLMOGOROV statistic DPLUS = 0.34358
Estimated KOLMOGOROV statistic DMINUS = 0.176351
Estimated overall statistic DN = 0.34358
Approximate significance level = 0.478176

Distribution Fitting

Data: HALL.PbON

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 13

Mean: 235.043

Standard deviation: 493.206

Log-Normal
Pb ON

Estimated KOLMOGOROV statistic DPLUS = 0.181276
Estimated KOLMOGOROV statistic DMINUS = 0.282018
Estimated overall statistic DN = 0.282018
Approximate significance level = 0.726492

Kolmogorov-Smirnov Two-Sample Test

Sample 1: HALL.BaOFF

Sample 2: HALL.BaON

Estimated overall statistic DN = 0.333333
Two-sided large sample K-S statistic = 0.57735
Approximate significance level = 0.892778

Kolmogorov-Smirnov Two-Sample Test

Sample 1: HALL.CrOFF

Sample 2: HALL.CrON

Estimated overall statistic DN = 0.833333
Two-sided large sample K-S statistic = 1.44338
Approximate significance level = 0.0310076

Kolmogorov-Smirnov Two-Sample Test

Sample 1: HALL.PbOFF

Sample 2: HALL.PbON

Estimated overall statistic DN = 0.666667
Two-sided large sample K-S statistic = 1.1547
Approximate significance level = 0.13892

Distribution Fitting

Data: HALL.BaALL

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 14

Mean: 116.358

Standard deviation: 86.6468

Barium, Normal dist'n. All data

Estimated KOLMOGOROV statistic DPLUS = 0.156803

Estimated KOLMOGOROV statistic DMINUS = 0.0968531

Estimated overall statistic DN = 0.156803

Approximate significance level = 0.929501

Lilliefors Critical value at $\alpha=.05$ and
 $N=12 = .242$

\therefore Accept hypothesis that
a normal dist'n fits.

Distribution Fitting

Data: HALL.BaALL

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 13

Mean: 290.906

Standard deviation: 1328.03

Barium, Log normal

Estimated KOLMOGOROV statistic DPLUS = 0.187291
Estimated KOLMOGOROV statistic DMINUS = 0.329104
Estimated overall statistic DN = 0.329104
Approximate significance level = 0.148571

Lilliefors critical value @ $\alpha = .05$ and
 $N = 12$ is .242

\therefore Do not accept hypothesis
that a log-normal dist'n fits

Distribution Fitting

Data: HALL.CrALL

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 14

Mean: 244.254

Standard deviation: 660.699

Chromium, Normal test, All data

Estimated KOLMOGOROV statistic DPLUS = 0.427047

Estimated KOLMOGOROV statistic DMINUS = 0.356369

Estimated overall statistic DN = 0.427047

Approximate significance level = 0.0251294

Lilliefors crit. value at $\alpha = .05$ and
 $N = 12$ is .242
 \therefore do not accept hypothesis that
dist'n is normal.

Distribution Fitting

Data: HALL.CrALL

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 13

Mean: 225.891

Standard deviation: 1376.19

Log Normal Chromium, all data

Estimated KOLMOGOROV statistic DPLUS = 0.19308
Estimated KOLMOGOROV statistic DMINUS = 0.206261
Estimated overall statistic DN = 0.206261
Approximate significance level = 0.686966

Lilliefors crit. val. @ .05 and N=12
is .242

∴ Accept H_0 that log normal
dist'n.

Distribution Fitting

Data: HALL.PbALL

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 14

Mean: 108.758

Standard deviation: 138.817

Normal, Lead, all data

Estimated KOLMOGOROV statistic DPLUS = 0.263936

Estimated KOLMOGOROV statistic DMINUS = 0.227397

Estimated overall statistic DN = 0.263936

Approximate significance level = 0.373289

Lilliefors critical value @ .05 and N=12
is .242

∴ do not accept H_0 is normal

Distribution Fitting

Data: HALL.PbALL

Distributions available:

- | | | |
|-----------------------|------------------|------------------|
| (1) Bernoulli | (7) Beta | (13) Lognormal |
| (2) Binomial | (8) Chi-square | (14) Normal |
| (3) Discrete uniform | (9) Erlang | (15) Student's t |
| (4) Geometric | (10) Exponential | (16) Triangular |
| (5) Negative binomial | (11) F | (17) Uniform |
| (6) Poisson | (12) Gamma | (18) Weibull |

Distribution number: 13

Mean: 127.875

Standard deviation: 280.418

Lead, all data, log normal

Estimated KOLMOGOROV statistic DPLUS = 0.142163
Estimated KOLMOGOROV statistic DMINUS = 0.197025
Estimated overall statistic DN = 0.197025
Approximate significance level = 0.740114

Kolmogorov crit. value at $N=12$ and $\alpha=.05$ is,
.242

∴ Accept H_0 That log-normal distⁱ
fits